CLAIMS

1. A communications apparatus, comprising:

an optical demultiplexer receiving an optical pulse on a first waveguide and dividing it into its wavelength components on a plurality of second waveguides;

a plurality of separately controlled phase modulators disposed on respective ones of said second waveguides to phase modulate said wavelength components; and

an optical multiplexer connected to said second waveguides and combining said wavelength components into a third waveguide.

2. The apparatus of Claim 1, wherein said demultiplexer and said multiplexer comprise respective array waveguide gratings.

3. The apparatus of Claim 2, wherein said demultiplexer, phase modulators, and multiplexer are formed in an InP substrate.

4. The apparatus of Claim 1, wherein said demultiplexer, phase modulators, and multiplexer are formed in a substrate.

5. The apparatus of Claim 1, further comprising an optical pulse generator producing said optical pulse to have a pulse width of no more than 10ps.

6. The apparatus of Claim 5, wherein said optical pulse generator has a pulse repetition rate of at least 1Gb/s.

7. The apparatus of Claim 1, wherein said optical pulse is received from an optical communications network.

8. The apparatus of Claim 1, wherein said plurality of phase modulators comprise at least eight phase modulators.

9. A CDMA communications system, comprising:

a transmitter including

a source of optical pulses having a pulse width of no more than 10ps,

a first optical demultiplexer receiving said optical pulses and dividing them into

first wavelength components thereof on a plurality of first waveguides,

a plurality of separately controlled first phase modulators disposed on respective ones of said first waveguides to phase modulate said first wavelength components according to a first code, and

a first optical multiplexer connected to said first waveguides and combining said wavelength components into a second waveguide configured for input to an optical transmission system; and

a receiver including

a second optical demultiplexer configured to receive optical signals from said optical transmission system and dividing them into second wavelength components thereof on a plurality of second waveguides,

a plurality of separately controlled second phase modulators disposed on respective ones of said second waveguides to phase modulate said second wavelength components according to a second code, and

a second optical multiplexer connected to said second waveguides and combining said second wavelength components, and

an optical detector receiving said combined second wavelength components.

10. The communication apparatus of Claim 9, wherein when said optical pulses from said source are modulated to form a data pulse train, when second code is a conjugate of said first code, said data pulse train is reconstructed at an output of said optical detector.

11. The communication apparatus of Claim 9 formed into no more than four substrates.

12. The communications apparatus of Claim 11 formed into no more than two of said substrates.

13. The communications apparatus of Claim 12, formed into no more than one said substrate.

14. The communication apparatus of Claim 9 comprising a plurality of said transmitters and a plurality of said receivers.

15. The communications apparatus of Claim 9, wherein said optical detector is an asymmetric Mach-Zehnder detector comprising:

two arm waveguides receiving an output of said second optical multiplexer them therethrough with propagation delays differing by a predetermined time and also receiving on both of said arms a predetermined probe signal;

two active regions disposed on said two arm waveguides; and

a photo detector receiving a combined output of said two arms.

16. The communications apparatus of Claim 15, wherein said two active regions include positive biased semiconductor junctions, whereby said combined output is an output pulse having a pulse width of at least but equal to but less than twice said predetermined time.

17. A Mach-Zehnder detector, comprising:

two arm waveguides receiving an input pulse and passing them therethrough with propagation delays differing by a predetermined time and also receiving on both of said arms a predetermined probe signal; and

two active regions disposed on said two arm waveguides,

whereby when outputs of said two arm waveguides are recombined an output pulse is produced having a pulse width of at least but not substantially more than said predetermined time.

18. The detector of Claim 17, wherein said input pulse has a pulse width of no more than 10ps.

19. The detector of Claim 17, further comprising:

a substrate in which said arm waveguides and active regions are formed; and

a laser producing said probe signal formed in said substrate.

20. A fiber dispersion compensator, comprising:

a substrate;

a first arrayed waveguide grating configured to have one side connected to an optical fiber to be compensated;

a plurality of first waveguides connected to a second said of said first arrayed waveguide grating;

respective separately controlled phase modulators disposed on said waveguides; and

a second arrayed waveguide grating connected on a first side to said first waveguides and on a second side to a second waveguide;

wherein said phase modulators are separately controllable to compensate for a dispersion on said fiber for a pulse on said second waveguide.

21. The compensator of Claim 20, further comprising means for impressing a plurality of respective electrical signals on respective ones of said modulators in compensation for said dispersion on said fiber.

22. An O-CDMA communication method, comprising the steps of:

at a transmitter

generating a sequence of optical pulses having a pulse width of no more than 10ps,

modulating said optical pulses according to a binary first data signal,

spectrally separating said modulated optical pulses into first wavelength components,

electrically phase modulating said first wavelength components according to a selected first one of a plurality of CDMA codes;

spectrally combining said phase modulated first wavelength components to produce an encoded signal for transmission onto an optical communications network; and

at a receiver

spectrally separating a signal received from said optical communications network into second wavelength components,

electrically phase modulating said second wavelength components according to a selected second one of said plurality of CDMA codes,

spectrally recombining said phase modulated second wavelength components to produce a decoded signal, and

detecting said decoded signal to produce a detected data signal.

23. The method of Claim 22, wherein said detected data signal is substantially more similar to said first data signal is said first one and said second one of said plurality of CDMA codes are the same than if they are different.

24. The method of Claim 22, wherein said steps are performed in no more than four monolithically integrated substrates.

25. The method of Claim 22, wherein said CDMA codes comprise at least four levels.